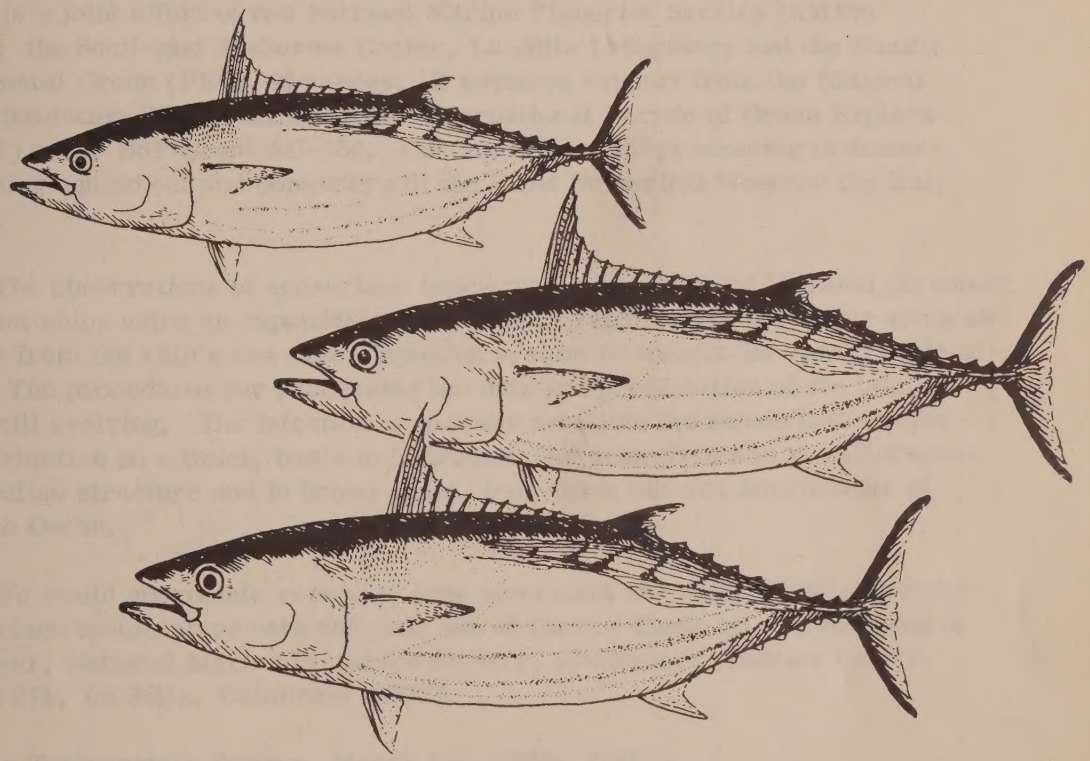
MARCH 1972, No. 3

FISHING INFORMATION

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



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NATIONAL MARINE FISHERIES SERVICE

SOUTHWEST FISHERIES CENTER LA JOLLA, CALIFORNIA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

FISHING INFORMATION

MARCH 1972 No. 3

VERTICAL SECTIONS OF SUBSURFACE TEMPERATURE IN THE NORTHEAST PACIFIC

In this issue we introduce, on an experimental basis, a new series of charts which will show recent subsurface temperature structure across the California Current along the merchant ship route between Honolulu and San Francisco. The project to obtain subsurface temperature sections about twice a month, is a joint effort of two National Marine Fisheries Service (NMFS) activities: the Southwest Fisheries Center, La Jolla Laboratory and the Pacific Environmental Group (PEG), Monterey. It receives support from the National Science Foundation (NSF), Office for the International Decade of Ocean Exploration (IDOE) under NSF Grant AG-256. Certain of the data processing is accomplished using equipment and computers of the Fleet Numerical Weather Central, Monterey.

The observations of subsurface temperature are made by licensed personnel of merchant ships using an expendable bathythermograph system and water samples are drawn from the ship's sea water injection system to analyze for (near) surface salinity. The procedures for processing the data and presentation of the information are still evolving. The intention is to make available the subsurface temperature information on a timely basis to fishermen and scientists who are interested in thermocline structure and in broad-scale, long-term air-sea interactions in the Pacific Ocean.

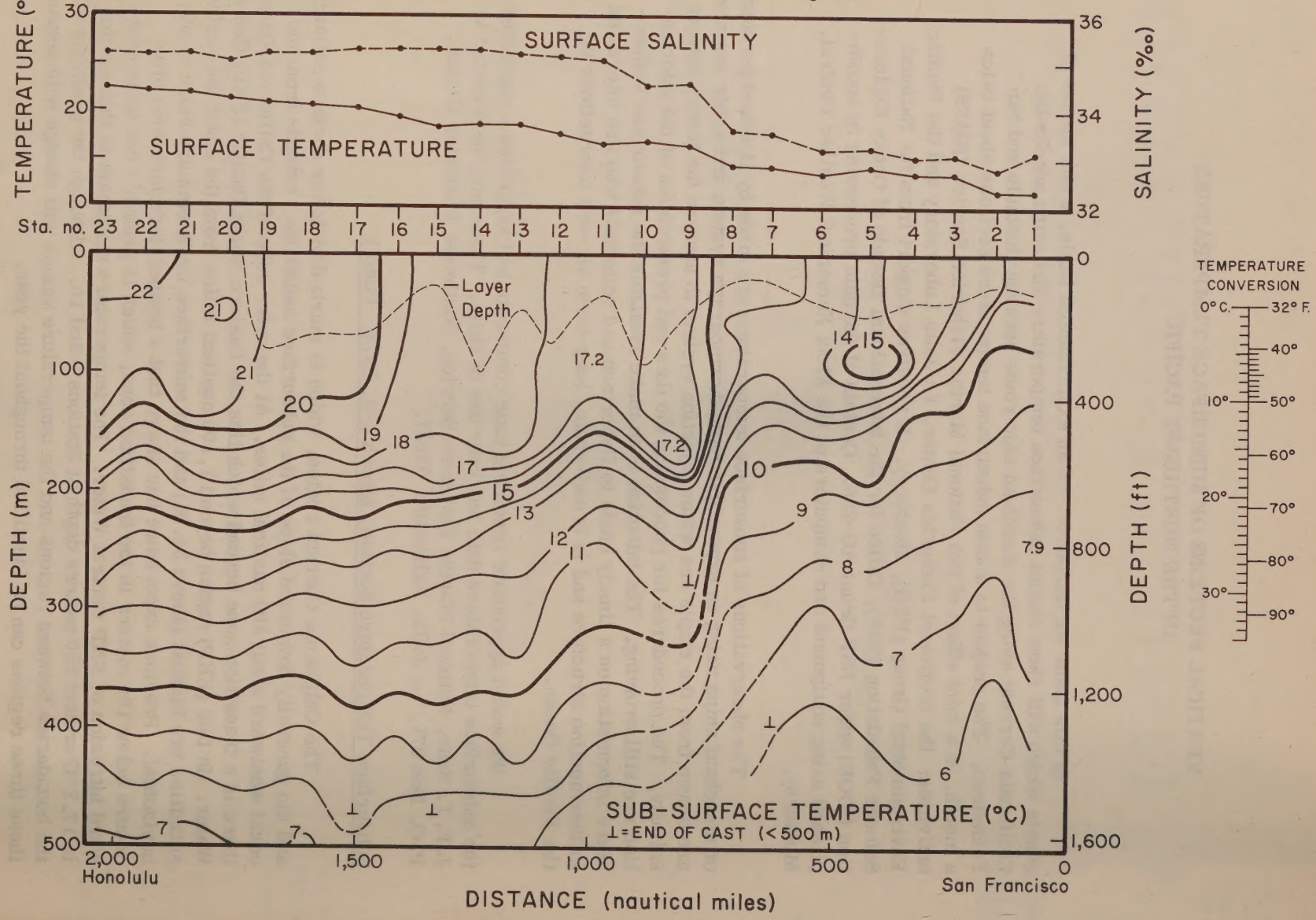
We would appreciate receiving your comments and suggestions regarding the subsurface temperature data and your use of them. These may be directed to J. F. T. Saur, National Marine Fisheries Service, Southwest Fisheries Center, P. O. Box 271, La Jolla, California 92037.

Subsurface Temperature Section, March 4-8, 1972: Plate 1

The California Current region, which is marked by lower surface salinities and the generally downward slope of the subsurface isotherms, extends from the coast westward about 800 nautical miles. At the outer edge of the California Current there is a transition zone beyond which lies the Eastern North Pacific (ENP) Central Water. In this (ENP) region beyond 1,100 nautical miles from the coast the surface salinities are highest (above 34.5‰) and the subsurface isotherms are more nearly horizontal. Previous experience has shown that a temperature inversion often occurs below 100 meters in the transition zone, which is probably due to an eastward intrusion of ENP Central Water. The temperature maximum in this section is 17.2° C around 150 meters depth at Stations 9 and 10. Although the positions of the boundaries between regions and the temperature values will change with season these three regions can be identified throughout the year.

MARCH 4-8, 1972 PLATE 1.

SS HAWAIIAN ENTERPRISE, Voy. 37 (ship track shown on fig. 3)



As compared to conditions in previous years for which we have similar vertical sections (1967 through 1970) the transition zone is relatively narrow, being only about 200 nautical miles wide. This creates a sharp contrast in conditions across the zone which is apparent in the horizontal change in surface salinity, the average temperature of the upper layers, and the temperature at depths of 200-400 meters. These conditions imply that the current to the southeast across the section in this region is stronger than in the other years.

In early March, the surface layer was generally not well mixed. Many irregularities and small transient temperature changes occurred in the upper layers. Even allowing for changes of $\pm$ 0.3°C from the surface temperature the depth of the mixed layer was generally less than in previous years. This is probably the result of light winds (generally less than 16 knots) for this time of year and the absence of storms in the area of the ship's track during early March. However, the heat content of the upper 100 meters indicates generally cooler conditions in the upper layers along the section except for 500 nautical miles nearest the California coast. In this region, it is warmer than it was in 1969 but cooler than in 1968.

Another prominent feature is the subsurface temperature maximum of 15°C which occurs at a depth of about 75 meters and 400 nautical miles from the coast in the California Current region. This feature indicates that the main southeasterly flow is separated into two parts, one which lies between 700 and 800 miles offshore (between stations 8 and 10) and the other is inshore extending from the coast out to about 400 nautical miles. In the intervening region between 400 and 700 miles the southeast component of the current is probably weak or may be reversed. This characteristic has been noted in several spring and summer sections from previous years and may be similar to that in the eastern South Pacific off Peru where a poleward countercurrent imbedded between two major equator-ward currents has been described by K. Wyrtki.

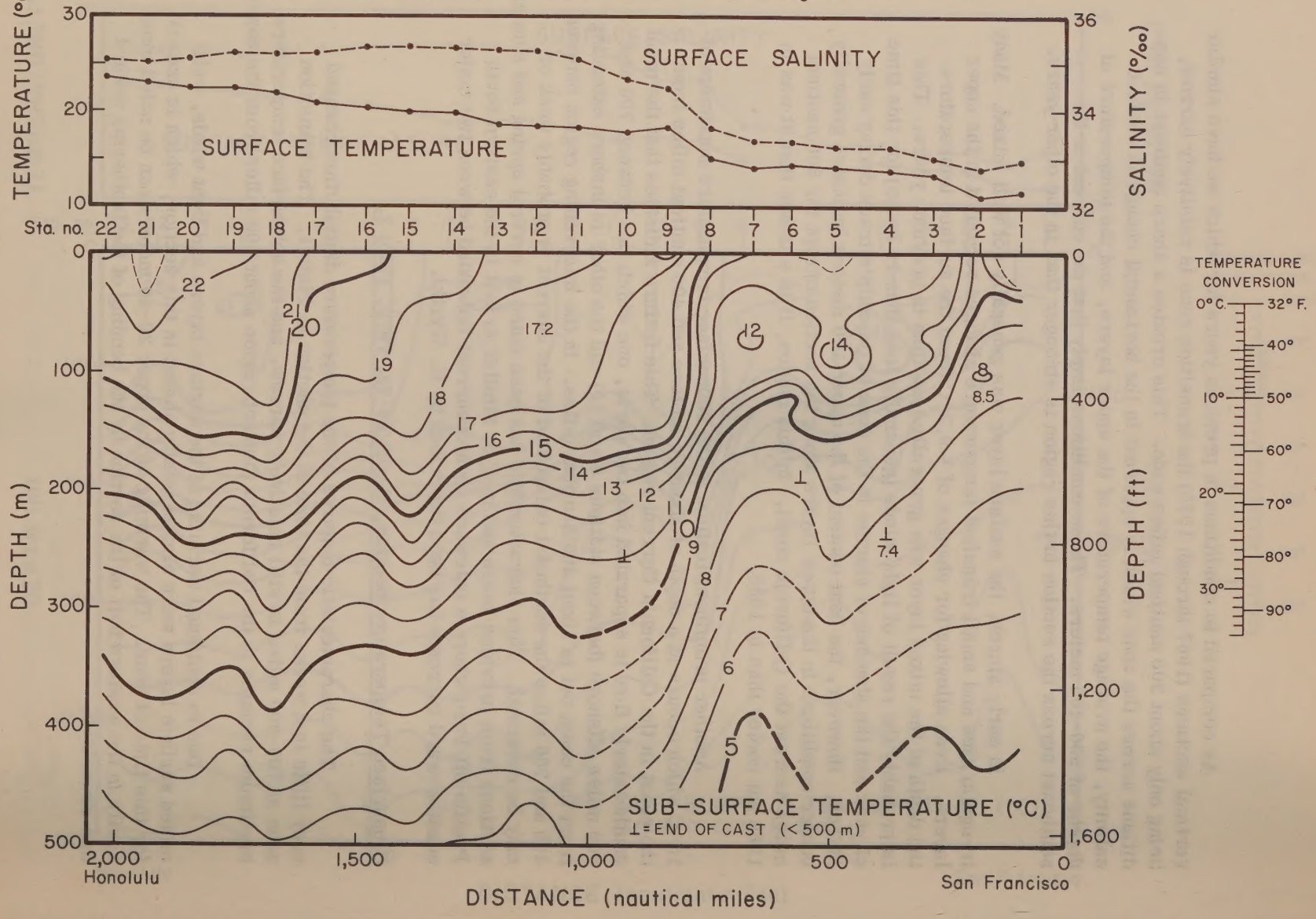
Subsurface Temperature Section, March 18-22, 1972, Plate 2.

The characteristic features of the temperature distribution changed very little in 2 weeks from the time of the section in Plate 1. The transition zone at 700-800 miles is still relatively narrow, and the subsurface temperature maximum remains in the California Current region about 500 miles from the coast.

Due to continued warming of the surface layers and light winds, well mixed surface layers were almost totally absent in this section, which is unusual for this time of year. The warming of the upper 30-40 meters can be noted most easily in the western half of the section by the bending of the isotherms toward San Francisco.

MARCH 18-22, 1972 PLATE 2.

SS HAWAIIAN ENTERPRISE, Voy. 38 (ship track shown on fig. 3)



In spite of the surface warming the heat content of the upper 100 meters still indicates cooler conditions over the entire section than in previous years. In the California Current out to about 700 miles the average temperature of the upper 100 meters decreased by over 0.5°C. This is further evidence that the California Current may be stronger than in previous years.

NARRATIVE DESCRIPTION OF OCEAN TEMPERATURE CONDITIONS

MARCH 1972

Northeastern Pacific

Since November 1971, thermal conditions in the eastern North Pacific have been characterized by above-normal temperatures over a large central oceanic region between latitudes 25°N and 50°N, lying to the west of longitude 140°W, while below-normal temperatures prevailed in a broad zone extending southward from the Gulf of Alaska along the coast and spreading westward to Hawaii in the area south of 25°N. During March 1972 this pattern appeared to be weakening (see Figure 5). The warm "pool", denoted by the positive deviations from normal, shifted eastward and the size of the area in which deviations exceeded 4°F was much reduced. This change in pattern reflects cooling which occurred during March, in the region west of 150°W between latitudes 30°N and 40°N, and warming to the east of 150°W. The abnormal sea temperature changes are the result of the unseasonal occurrence of strong cyclonic circulation in the first and last weeks of the month, centered between latitudes 35°N and 40°N, at about 155°W. Figure 2 shows there was a low pressure cell in this region with central pressures of 1,004 mb or less, which is at least 12 mb below normal. Northerly winds west of the low center contributed to cooling through advection or movement, of cold water southward. Similarly, southerly winds east of the low center caused warming through advection of warm water northward. The close coincidence of the region of higher-than-normal sea temperature with the low pressure cell may not be entirely coincidental, in view of a hypothesis held by some meteorologists, that generation of cyclonic circulation can be associated with large pools of relatively warm water.

In the 2nd and 3rd weeks of March, the main area of cyclonic activity was north of latitude 40°N and west of 140°W. The accompanying southwesterly winds in the southeast sector caused a northward movement of surface water and a consequent warming of sea surface temperatures, especially between latitudes 40°N and 45°N, from 140°W to 150°W. This process contributed further to the eastward shift of the region of above-normal temperature.

A high pressure cell dominated the region south of latitude 40°N between 140°W and the coasts of California and Baja California throughout the month. The gradients northeast and east of the high center were weaker than normal, however, resulting in a relaxation of the northwest wind regime and reduced advection of cold water southward. Also, trade winds upstream from Hawaii were frequently weak or absent, permitting a relaxation of the California Current extension and consequent warming of surface temperatures.

In summary, the well-defined pattern of anomalous temperature conditions which characterized the winter of 1971-72 is undergoing erosion and deformation through processes associated with an atmospheric circulation pattern whose structure may, in turn, have been induced through a feedback mechanism triggered by the anomalous temperatures.

Eastern Tropical Pacific

The warming trend which began last month in the surface waters of much of the eastern tropical Pacific, has continued in March 1972. Deviations from normal were positive in most of the equatorial zone from South America to longitude 140°W. Negative deviations persisted west of this longitude but with reduced magnitudes (Figure 8). While the warmest equatorial temperatures are only a few degrees above normal, they provide a striking contrast with the cold conditions of last year (Figure 9). Temperatures in the area off Guayaquil and along the equator from 120°W to 140°W were 6°F higher in March 1972 than in March 1971.

These conditions were associated with wind speeds 2-to-5 knots below normal owing to the absence of the easternmost cell of the south Pacific anticyclone. The warm surface temperatures combined with frequent passages of weather fronts farther south lead to increased convective activity and many squall lines along the ITCZ, which extended westward from Ecuador, near 5°S, during most of the month. At this time we do not feel that the temperatures in this area are indicative of an El Niño condition, however, we will continue to monitor them closely.

Temperature conditions also warmed off Central America, especially along the coast of Mexico, where negative deviations in February changed to positive in March. Contributing factors were reduced wind speeds and decreased cloud cover, relative to normal, resulting from an unusual southeastward extension of high pressure projecting from the northeast Pacific anticyclone.

An exception to the general warming of the eastern tropical Pacific was the cold spot centered near 7°N, 90°W, which possibly was a consequence of intensified upwelling in the Costa Rica Dome circulation.

Staff, Fishery-Oceanography Investigations
R. Michael Laurs, Leader

FARALLON ISLANDS NATIONAL WILDLIFE REFUGE

The Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, reminds fishermen and others operating in the vicinity of the Farallon Islands off San Francisco, that these islands are a National Wildlife Refuge and that all species of wildlife on these islands are protected by law.

The Bureau advises that the islands are patrolled by the Coast Guard and California Department of Fish and Game authorities, and by Bureau officers. The islands provide nesting sites for a variety of birds, as well as habitat for other kinds of wildlife, including seals and sea lions. Shooting and other acts of vandalism endanger the wildlife of the islands, and disturbance of any kind during the spring nesting season can seriously affect the production of wildlife.

Trollers working in this area are asked to avoid the islands whenever possible. Questions about the islands or activities on them may be directed to the Bureau of Sport Fisheries and Wildlife, 650 Capitol Mall, Room 4066, 4008 Federal Building, Sacramento, California 95814, or telephone Area Code 916, 449-2202.

SEA SURFACE TEMPERATURE CHARTS, PACIFIC OCEAN

MARCH 1972

Acknowledgements

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Hopkins Marine Station, Pacific Grove, California, J. P. Balesteri
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Living Marine Resources Inc., San Diego, California
National Oceanic and Atmospheric Administration
National Marine Fisheries Service, La Jolla, California; Honolulu, Hawaii; Seattle, Washington
National Weather Service, San Diego, California
National Ocean Survey, Pacific Marine Center, Seattle, Washington
Pacific Environment Institute, Fisheries Research Board of Canada West Vancouver, British Columbia, by H. J. Hollister from observations by J. Godin at Cape St. James Light; L. Collins at Kains Island Lightstation; O. A. Edwards at Amphitrite Point Light
Scripps Institution of Oceanography, La Jolla, California, by Margaret Robinson
U.S. Naval Weather Service, Fleet Numerical Weather Central, Monterey, California
Fishing Vessels ANTONIA C., APOLLO, BOLD CONTENDER, CALIFORNIAN, CAROL VIRGINIA, CONQUEST, EASTERN PACIFIC, ELIZABETH C. J., ELSINORE, FRANCES ANNE, GINA KAREN, INDEPENDENCE, JO LINDA, KATHLEEN, LOU JEAN II, MARY ANTONETTE, MARY BARBARA, MERMAID, POLARIS, QUEEN MARY, SAN JUAN, SANTA ROSA, SARATOGA, SEAQUEST, UNITED STATES, VIVIAN ANN

The cooperation of Matson Navigation Company and assistance of the Mates of the S.S. HAWAIIAN ENTERPRISE in obtaining the expendable bathythermograph observations for the vertical temperature sections is acknowledged.

Charts

Figure 1.--Twelve-year mean (1961-1972) observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots) and average wind speed (knots) regardless of direction.

Figure 2.--Observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots), and average wind speed (knots) regardless of direction.

Figure 3.--Mean sea surface temperature, eastern North Pacific Ocean. Squares show temperatures at weather ship stations. Numerals on shore are temperatures at coastal and lightship stations.

Figure 4.--Mean sea surface temperature chart, western North Pacific Ocean.

Figure 5.--Deviation of sea surface temperatures, eastern North Pacific Ocean from long-term charts of H. O. 225. Hatched areas are colder in 1972.

Figure 6.--Deviation of sea surface temperatures, eastern North Pacific Ocean from those of March 1971. Hatched areas are colder in 1972.

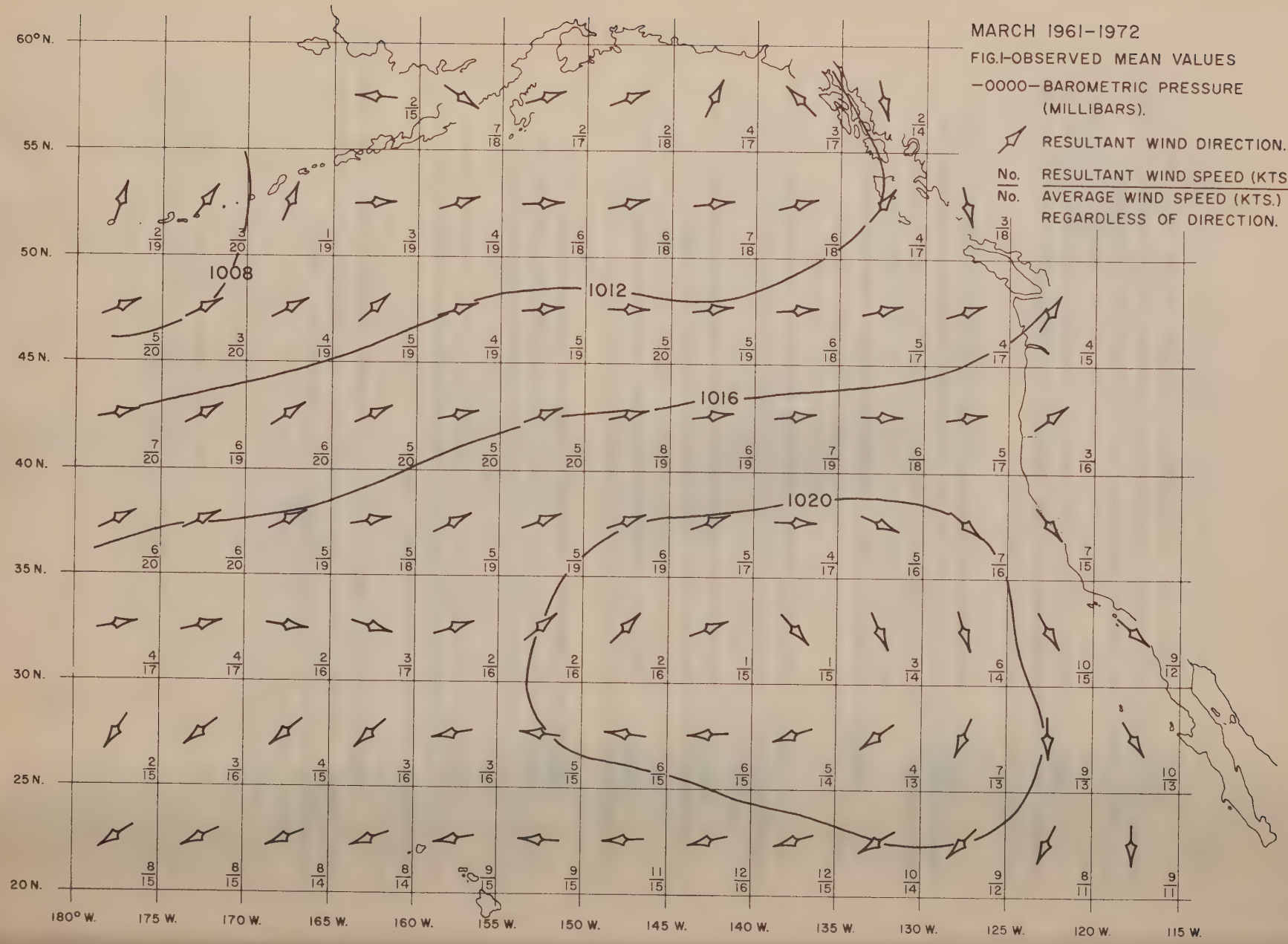
Figure 7.--Mean sea surface temperature, eastern tropical Pacific Ocean. Numerals on shore are temperatures at coastal stations.

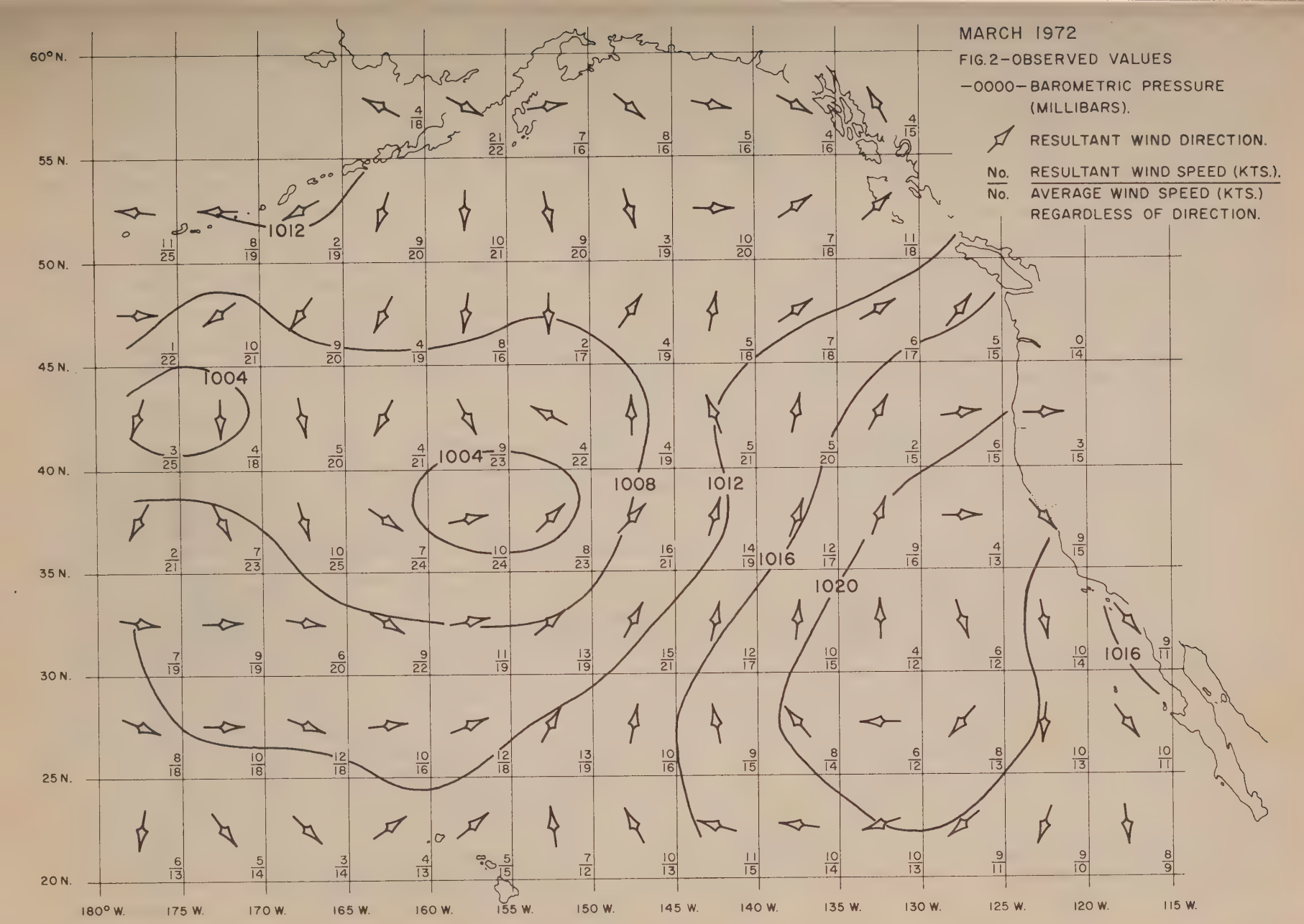
Figure 8.--Deviation of sea surface temperatures, eastern tropical Pacific Ocean from long-term charts of H. O. 225 and NAVOCEANO sp-123. Shaded areas are colder in 1972. Contours are dashed in sparse data areas.

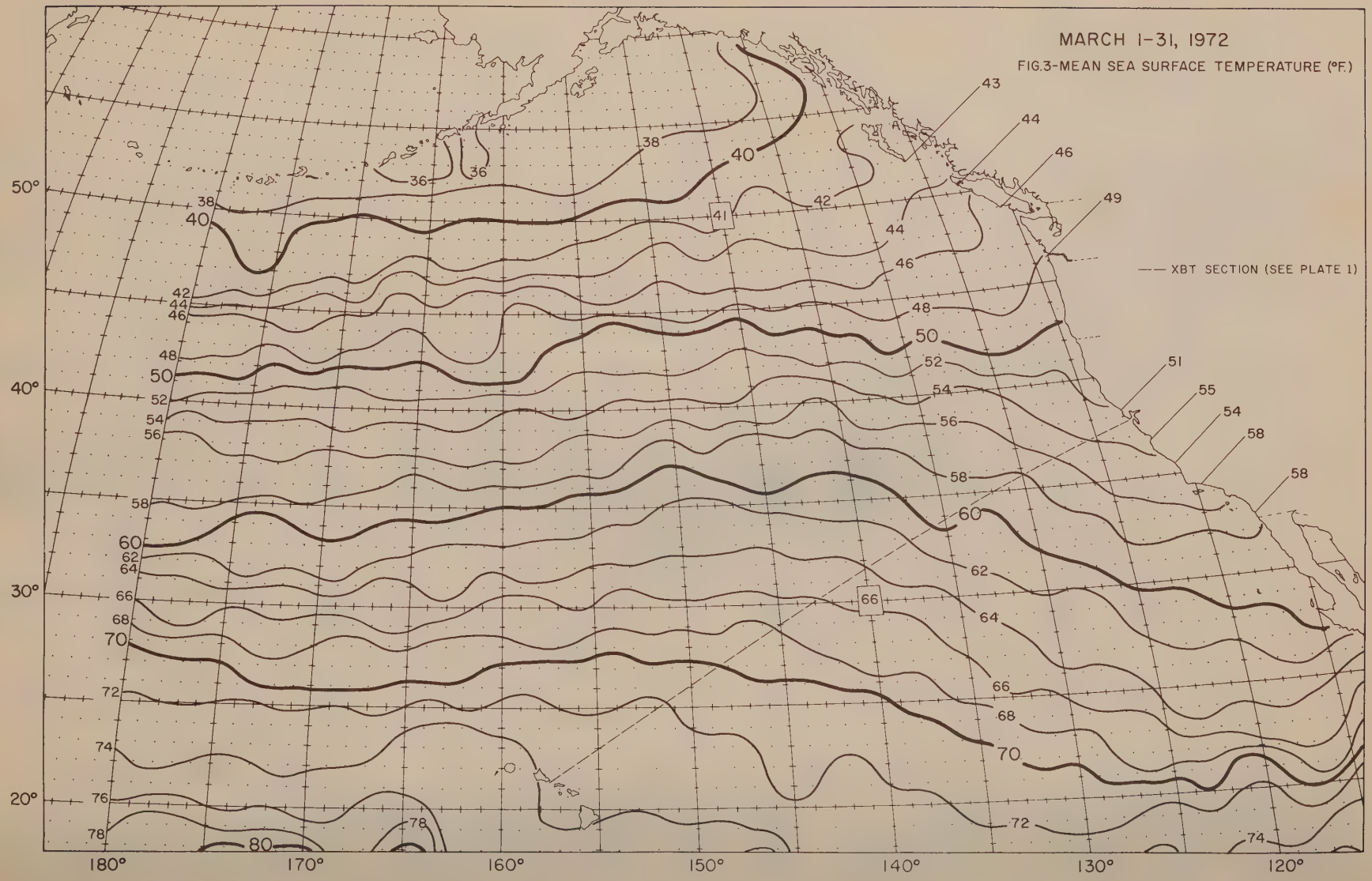
Figure 9.--Deviation of sea surface temperatures, eastern tropical Pacific Ocean from those of March 1971. Shaded areas are colder in 1972. Contours are dashed in sparse data areas.

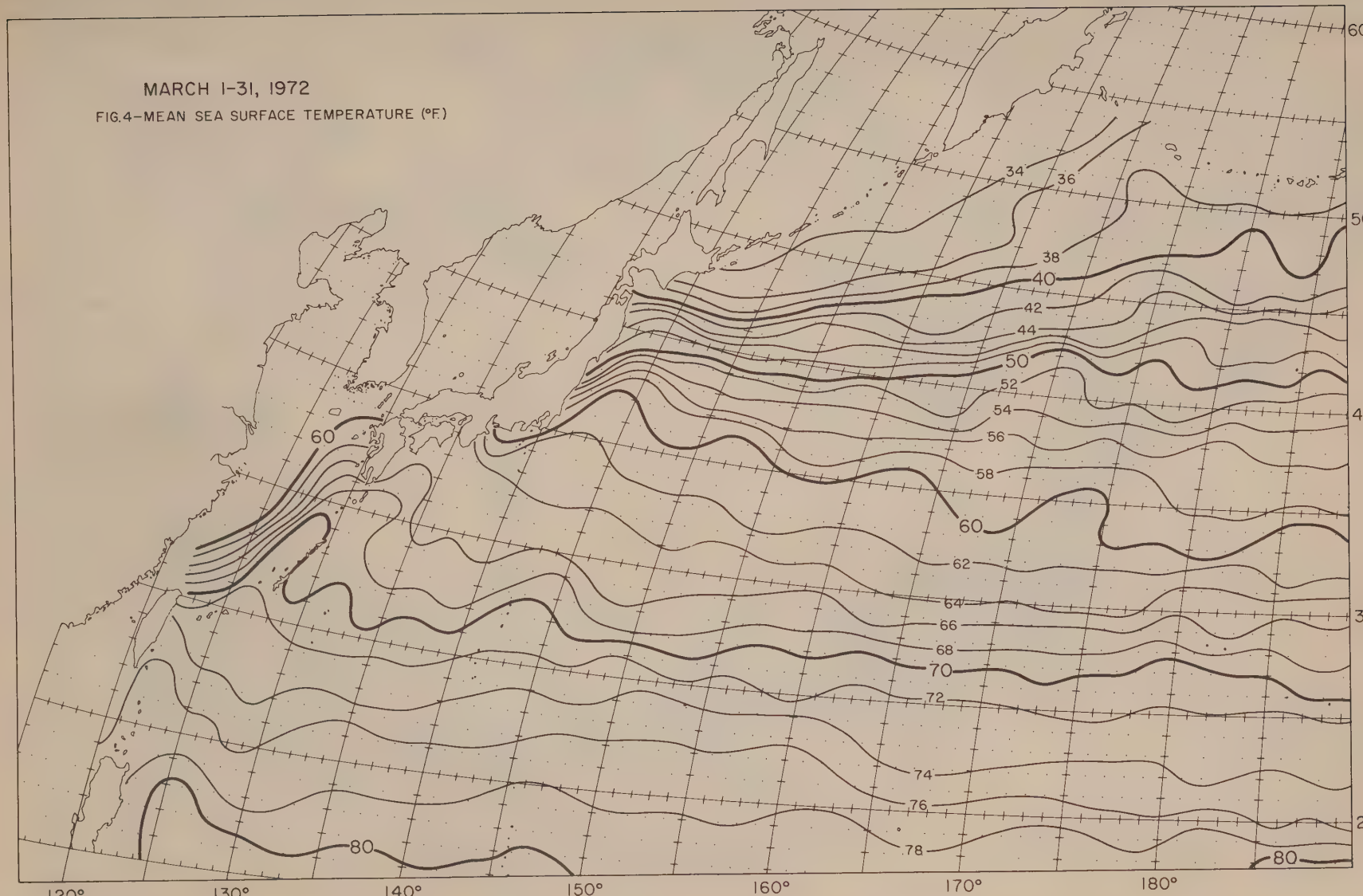
Mean sea surface temperature chart, western North Pacific Ocean, January 1-31, 1972. This chart, based on corrected data, replaces the corresponding chart appearing as Figure 4 in Fishing Information, January 1972, No. 1.

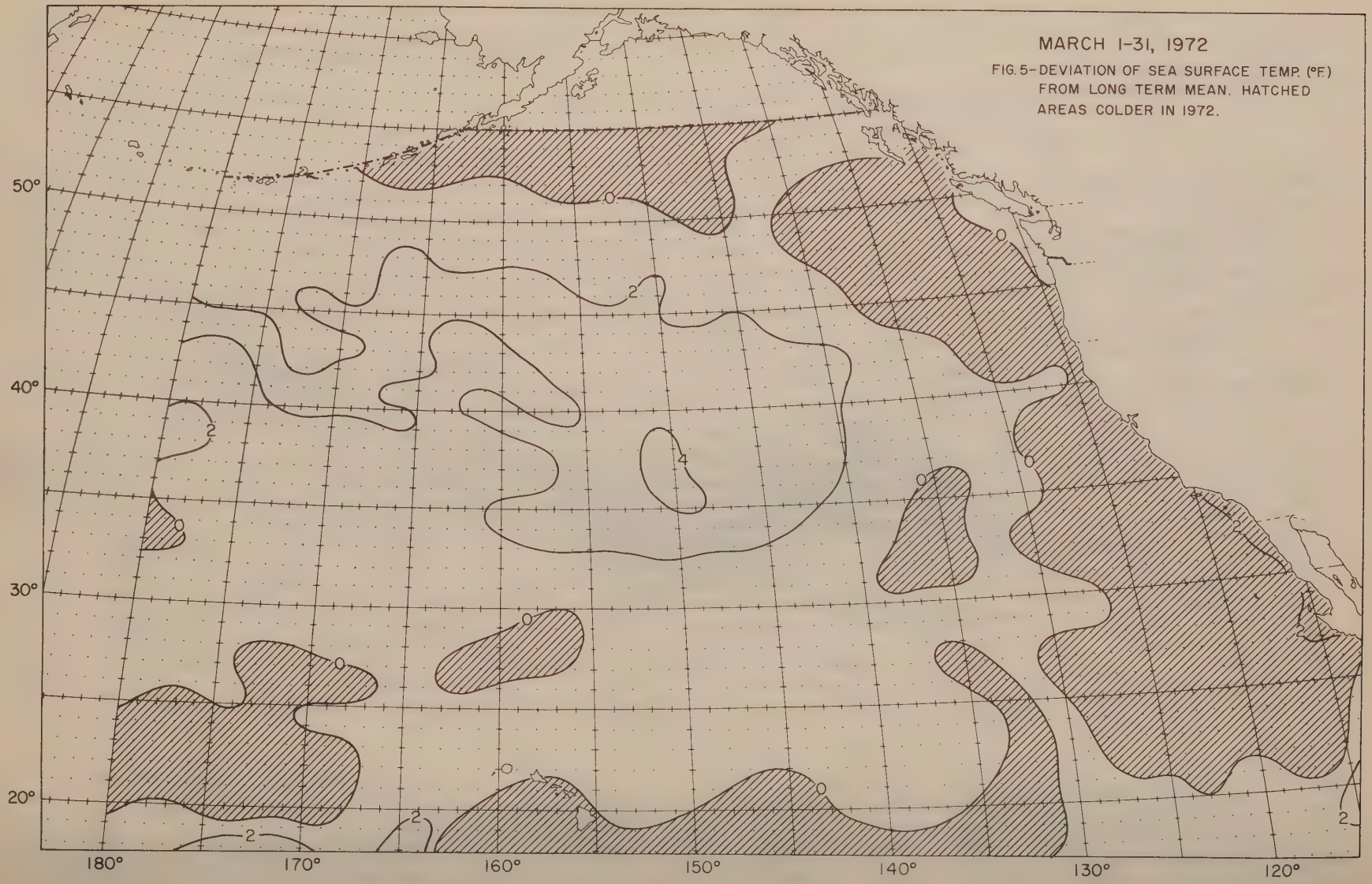
James A. Renner, Fishery Biologist
Kenneth S. Raymond, Scientific Illustrator
April 10, 1972

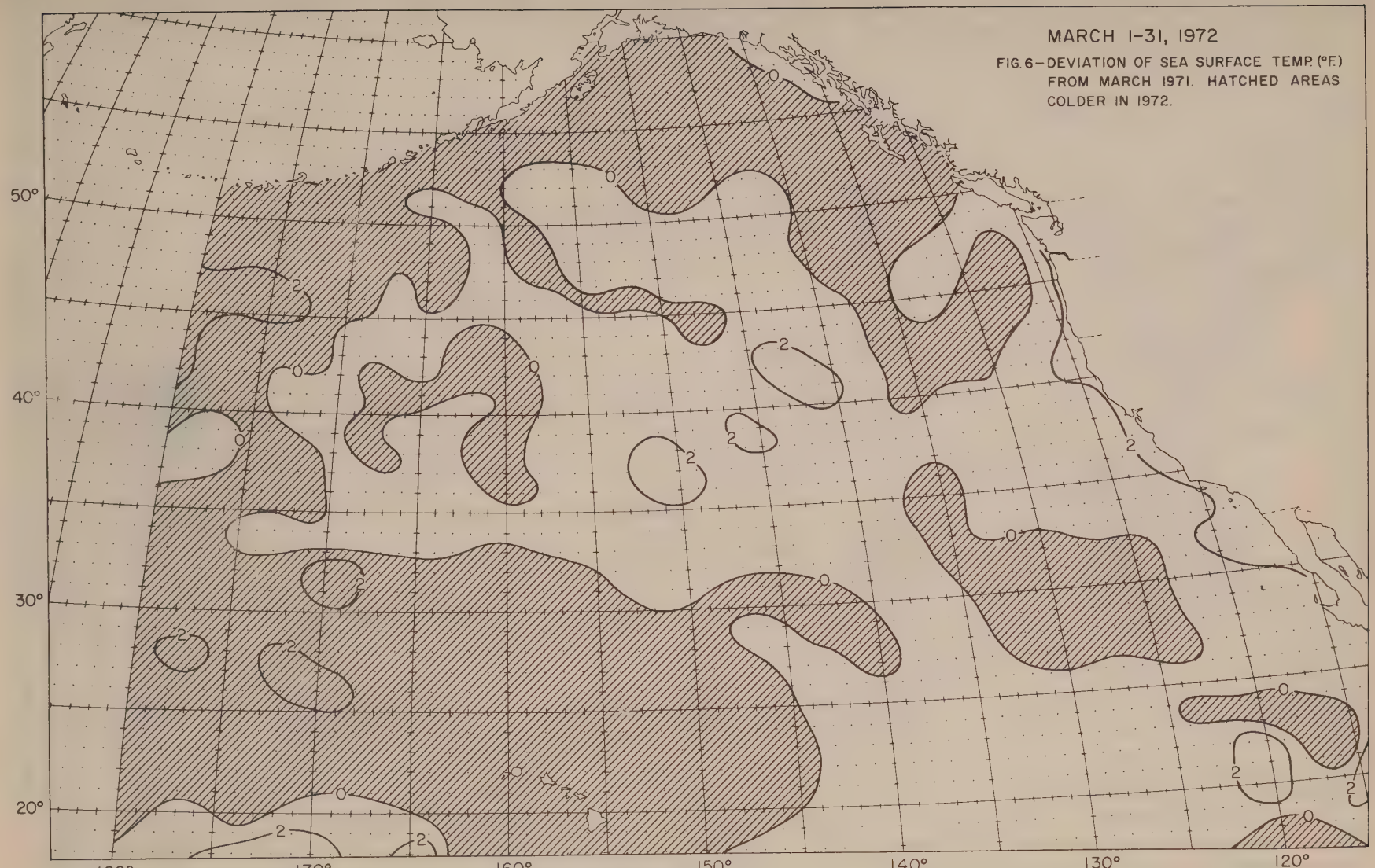

MARCH 1961-1972
FIG.1-OBSERVED MEAN VALUES
—0000— BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1008
1012
1016
1020
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.

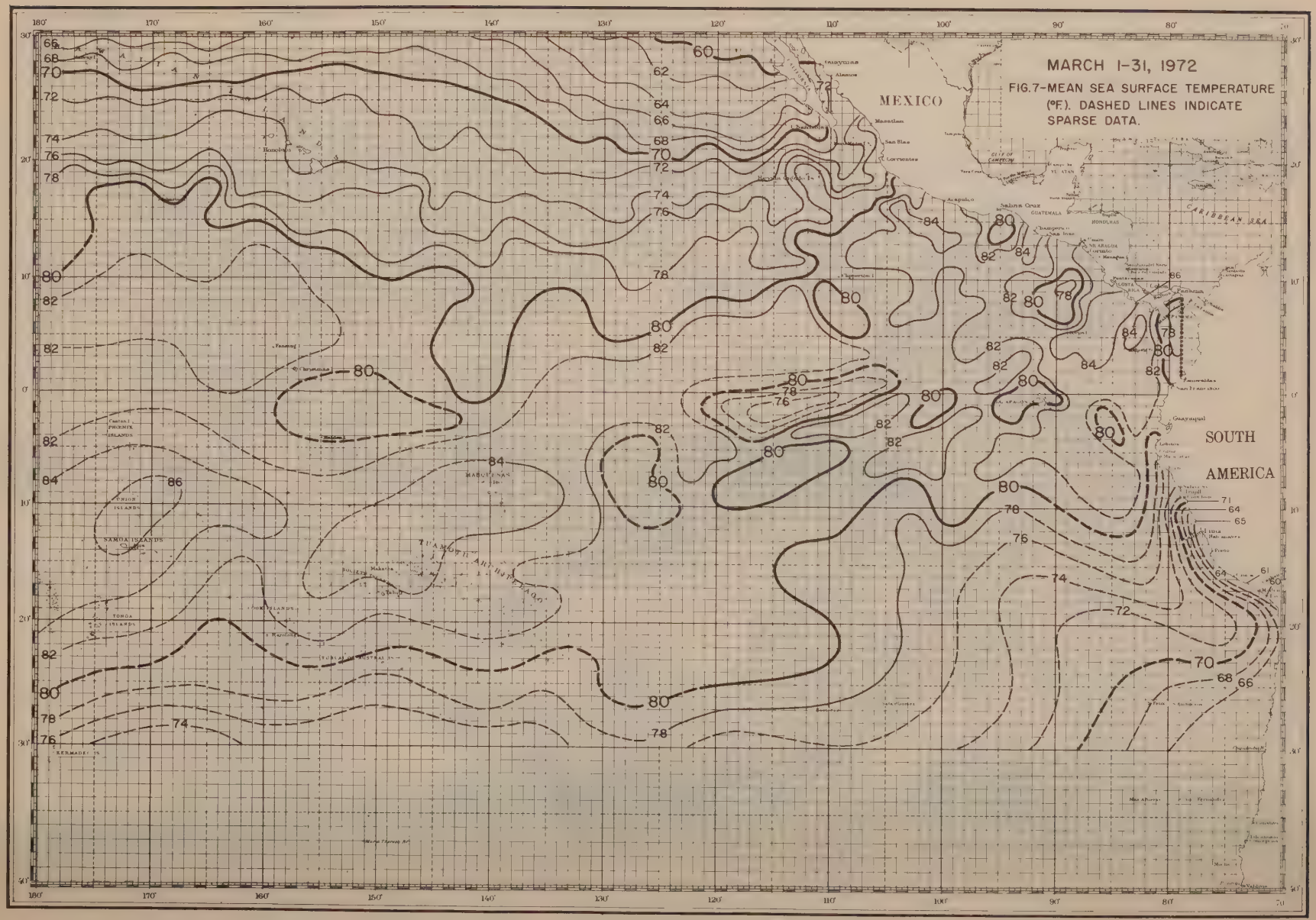

MARCH 1972
FIG. 2 – OBSERVED VALUES
–0000– BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. / No. RESULTANT WIND SPEED (KTS.). / AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.
1012
1004
1004
1008
1012
1016
1020
1016

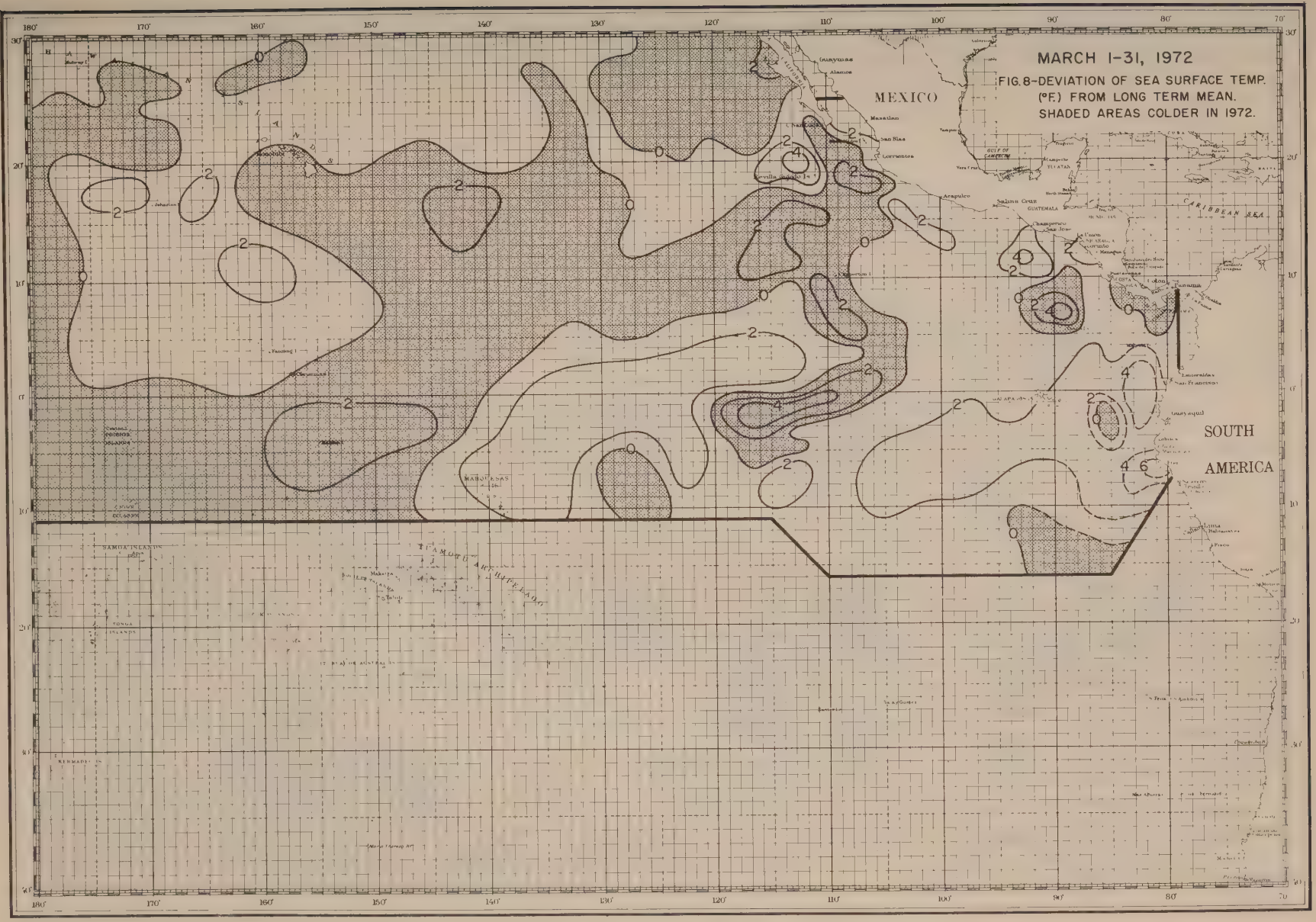

MARCH 1-31, 1972
FIG.3-MEAN SEA SURFACE TEMPERATURE (°F.)
XBT SECTION (SEE PLATE 1)
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°

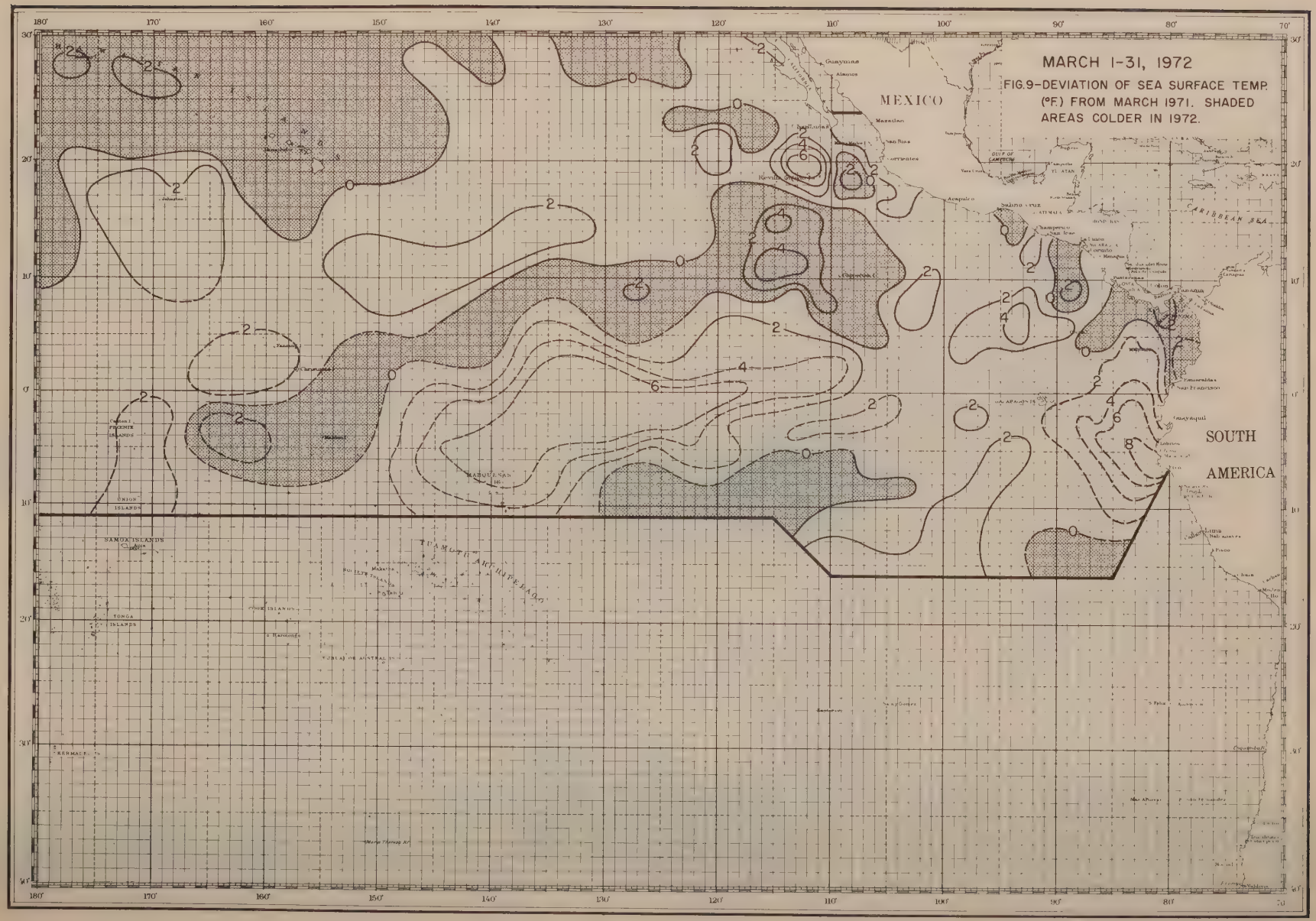

MARCH 1-31, 1972
FIG.4-MEAN SEA SURFACE TEMPERATURE (°F.)
34
36
38
40
42
44
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
60
80
60°
50°
40°
30°
20°
120°
130°
140°
150°
160°
170°
180°

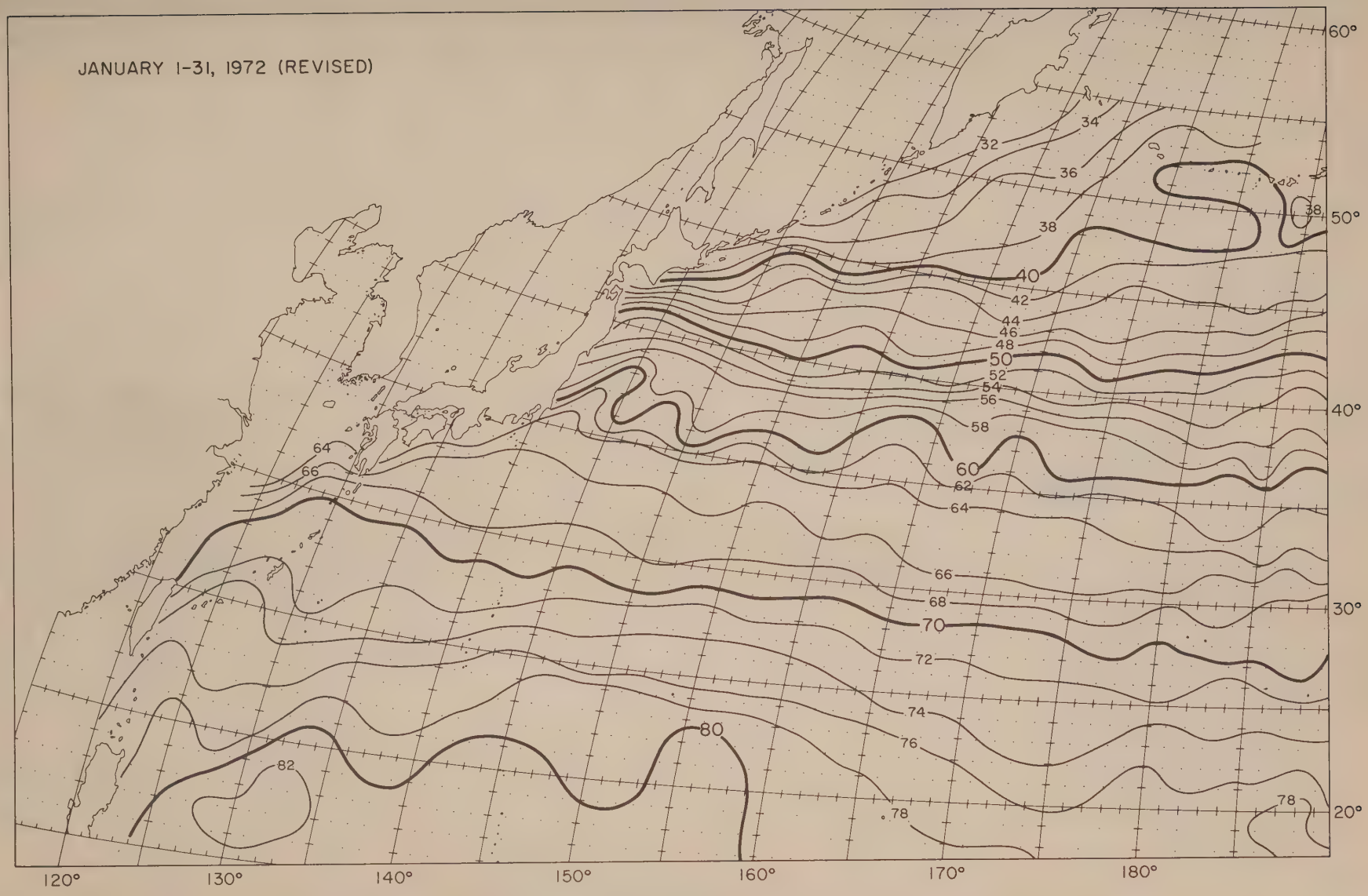

MARCH 1-31, 1972
FIG. 5-DEVIATION OF SEA SURFACE TEMP. (°F) FROM LONG TERM MEAN. HATCHED AREAS COLDER IN 1972.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2
4


MARCH 1-31, 1972
FIG.6—DEVIATION OF SEA SURFACE TEMP.(°F) FROM MARCH 1971. HATCHED AREAS COLDER IN 1972.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2

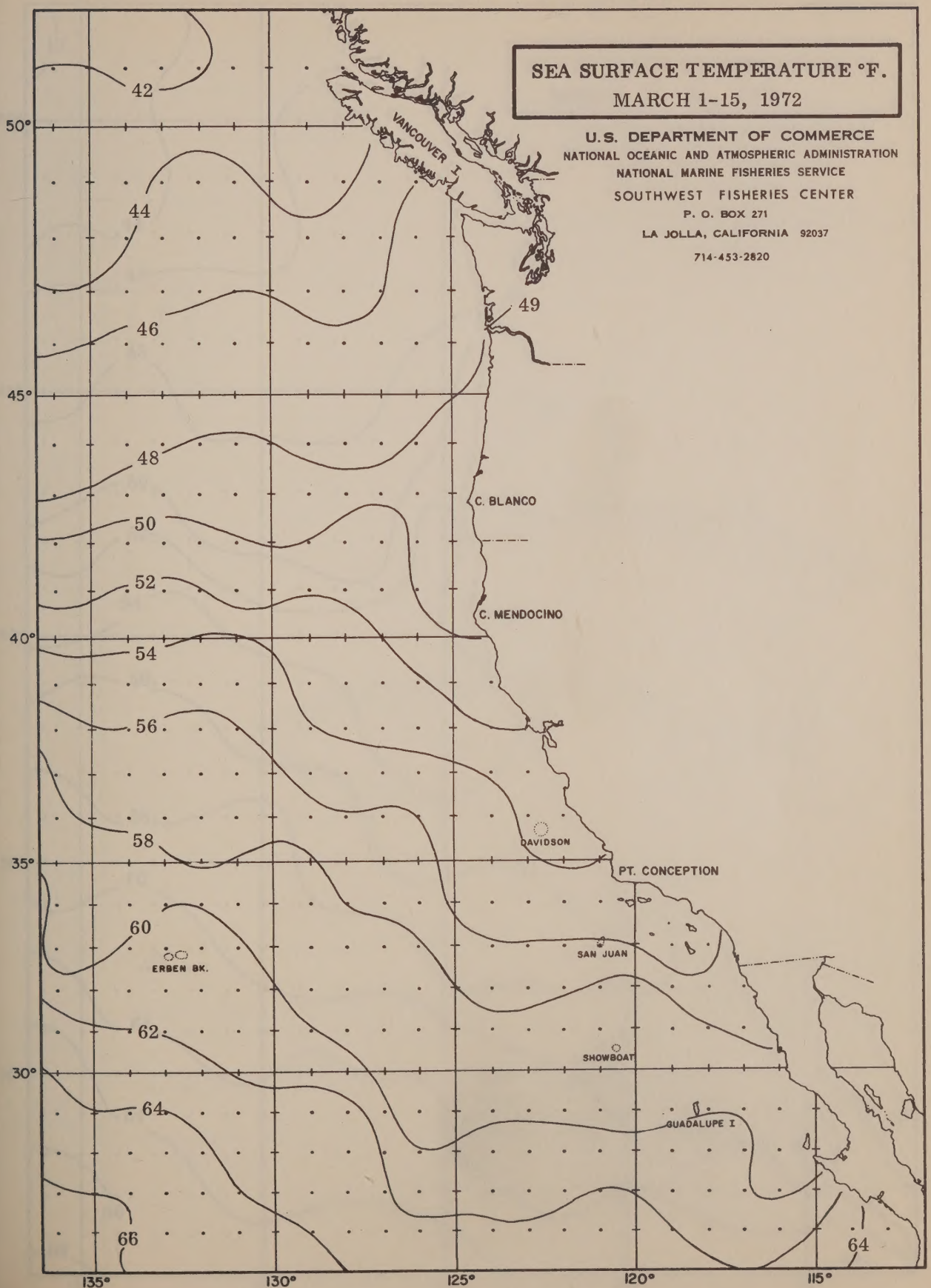

MARCH 1-31, 1972
FIG.7-MEAN SEA SURFACE TEMPERATURE (°F.). DASHED LINES INDICATE SPARSE DATA.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
HONDURAS
GUATEMALA
SAMOA ISLANDS
TONGA ISLANDS
PHOENIX ISLANDS
MARQUESAS
TUAMOTU ARCHIPELAGO
BERMUDA


MARCH 1-31, 1972
FIG.8-DEVIATION OF SEA SURFACE TEMP. (°F.) FROM LONG TERM MEAN.
SHADED AREAS COLDER IN 1972.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GUATEMALA
Panama
Acapulco
Guayaquil
Lima
Callao
Tahiti
Fanning I.
Christmas I.
Galapagos Islands
Marquesas Islands
Samoa Islands
Tonga Islands
Bermuda
Hawaiian Is.
Midway I.
Honolulu
Mazatlan
San Blas
Manzanillo
Salina Cruz
Champerico
Puerto Quetzal
Tumaco
Buenaventura
Talara
Chimbote
Callao
Pisco
Arica
Iquique
Antofagasta
Valparaiso
Easter I.
Juan Fernandez Is.
Pitcairn I.
Mururoa
Nuku Hiva
Papeete
Rapa
Raivavae
Rarotonga
Pago Pago
Apia
Suva
Nandi
Noumea
Auckland
Wellington
Norfolk I.
Lord Howe I.
Brisbane
Sydney
Melbourne
Hobart
Adelaide
Perth
Fremantle
Geraldton
Darwin
Port Moresby
Rabaul
Manus I.
Truk
Ponape
Kwajalein
Majuro
Eniwetok
Guam
Saipan
Yap
Palau Is.
Wake I.
Johnston I.
Palmyra I.
Canton I.
Enderbury I.
Christmas I.
Tarawa
Funafuti
Nauru I.
Honiara
Port Vila
Espiritu Santo
Nouméa
Gulf of California
Yucatan
Campeche
Veracruz
Tampico
Cuba
Haiti
Jamaica
Belize
Honduras
Nicaragua
Costa Rica
Panama
Colombia
Ecuador
Peru
Chile
Argentina
Uruguay
Brazil
Venezuela
Guyana
Suriname
French Guiana
Trinidad
Curaçao
Aruba
Bonaire
Puerto Rico
Virgin Is.
Leeward Is.
Windward Is.
Barbados
Martinique
Guadeloupe
Dominica
St. Lucia
St. Vincent
Grenadines
Grenada
Tobago
Netherlands Antilles
Marshall Is.
Gilbert Is.
Ellice Is.
Solomon Is.
New Hebrides
New Caledonia
Fiji Is.
Tonga Islands
Samoa Islands
Cook Is.
Society Is.
Tuamotu Archipelago
Marquesas Islands
Galapagos Islands
Easter I.
Juan Fernandez Is.
Pitcairn I.
Mururoa
Nuku Hiva
Papeete
Rapa
Raivavae
Rarotonga
Pago Pago
Apia
Suva
Nandi
Noumea
Auckland
Wellington
Norfolk I.
Lord Howe I.
Brisbane
Sydney
Melbourne
Hobart
Adelaide
Perth
Fremantle
Geraldton
Darwin
Port Moresby
Rabaul
Manus I.
Truk
Ponape
Kwajalein
Majuro
Eniwetok
Guam
Saipan
Yap
Palau Is.
Wake I.
Johnston I.
Palmyra I.
Canton I.
Enderbury I.
Christmas I.
Tarawa
Funafuti
Nauru I.
Honiara
Port Vila
Espiritu Santo
Nouméa
180°
170°
160°
150°
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
30°
40°
50°


MARCH 1-31, 1972
FIG.9-DEVIATION OF SEA SURFACE TEMP. (°F.) FROM MARCH 1971. SHADED AREAS COLDER IN 1972.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CALIFORNIA
Acapulco
Manzanillo
Guaymas
Mazatlan
Salina Cruz
Champerico
Callao
Guayaquil
Lima
Paita
Talara
Chimbote
Trujillo
Pisco
Iquique
Antofagasta
Valparaiso
Coquimbo
Concepcion
Mollendo
Arica
Tocopilla
PHOENIX ISLANDS
UNION ISLANDS
SAMOA ISLANDS
TONGA ISLANDS
COOK ISLANDS
TUAMOTU ARCHIPELAGO
MARQUESAS
TUBUAI OR AUSTRAL IS.
KERMADEC IS.
180°
170°
160°
150°
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
30°
40°


JANUARY 1-31, 1972 (REVISED)
60°
50°
40°
30°
20°
120°
130°
140°
150°
160°
170°
180°
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82

FISHING INFORMATION – supplement



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